DOCUMENT RESUME

ED 466 201 IR 021 272

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TITLE	Emergent-Collaboration in Web-Supported Academic Courses.
PUB DATE	2001-00-00
NOTE	7p.; In: ED-Media 2001 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Proceedings (13th, Tampere, Finland, June 25-30, 2001); see IR 021 194.
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 2966, Charlottesville, VA 22902 ($40, AACE members; $50, nonmembers). Tel: 804-973-3987; Fax: 804-978-7449; Web site: http://www.aace.org.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Computer Assisted Instruction; Computer Mediated Communication; *Cooperative Learning; Distance Education; *Educational Technology; Foreign Countries; Graduate Study; *Group Activities; Higher Education; Instructional Effectiveness; Preservice Teacher Education; World Wide Web
IDENTIFIERS	Tel Aviv University (Israel)

ABSTRACT

Emergent-collaboration is the process by which group configurations and transactional patterns evolve among participants during the course of learning. This study focused on the integration of a Web shell for supporting emergent-collaboration activities in 6 graduate courses (115 students) in the Tel-Aviv University School of Education. The research questions addressed the didactic modes that have been devised for supporting emergent-collaboration learning processes, and the extent of participation of students and teachers in Web-supported emergent-collaboration learning processes. Quantitative and qualitative data regarding different modes of collaboration are presented. The results indicate that the use of the technology affected learning and teaching processes in significant ways, increasing the students' participation and involvement in the courses, supporting a wide range of transactional modes, and contributing to the groups' social climate and collaborative work. (Author/AEF)

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Emergent-Collaboration in Web-Supported Academic Courses

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Abstract: Emergent-collaboration is the process by which group configurations and transactional patterns evolve among participants during the course of learning. This study focused on the integration of a Web shell for supporting emergent-collaboration activities in six graduate courses (115 students) in the Tel-Aviv University School of Education. The research questions addressed: (a) the didactic modes that have been devised for supporting emergent-collaboration learning processes, and (b) the extent of participation of students and teachers in Web- supported emergent-collaboration learning processes. Quantitative as well as qualitative data regarding different modes of collaboration are presented. The results indicated that the use of the technology affected learning and teaching processes in significant ways, increasing the students participation and involvement in the courses, supporting a wide range of transactional modes, and contributing to the groups' social climate and collaborative work.

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Web technology has become a powerful instructional means in higher education instruction (Bates, 2000; Collis, 1998; Flanagan & Egert, 2000). Among other salient capacities of the technology, its potential for supporting collaborative learning processes deserved particular attention among scholars and developers (e.g., Anderson & Kanuka, 1997). Collaborative learning refers to an instructional situation at which students interact while accomplishing an academic task. According to the partners' (students, teachers) needs and goals while performing learning assignments, interactions (among students, students and teachers, students and knowledge resources) may fulfill varied functions, e.g., co-operation, collaboration, competition, distribution (of knowledge), or sharing (of knowledge resources).

New technology-based models of collaboration imply an expansion and even a transformation of the variables, components and processes characterizing collaborative learning events (Sharan, 1994). Examples of issues affected by the use of the technology are: the *setting* of the activity (e.g., asynchronous non face-to-face interactions); the *dynamics* of the interactions (e.g., dynamic definition of ad-hoc roles and functions within the); the *configuration* of the group (e.g., occasional participation of additional partners according to emerging needs); or the variety of *communication means* used for interacting (e.g., mail, chat, collaborative-work tools).
In addition, we would like to distinguish here between two learning situations: structured and emergent-collaborative. Structured collaborative tasks are well planned didactic solutions that follows the conceptual guidelines proposed by researchers and practitioners. In contrast, emergent-collaboration is the process by which group configurations and transactional patterns evolve among participants during the course of learning, in correspondence with the (extent and quality of the) students involvement in the learning process and their commitment to different aspects of the task (Ogata, & Yano, 1999). As the task proceeds, transformations in the group functioning may occur, e.g., changes in configuration, exchange of roles, formation of ad-hoc subgroups. This shift in perception of collaborative processes has practical implications for the planning, implementation and research of collaborative learning situations. The planning process will focus now on the definition of goals and constraints, rather than on the detailed formulation of structural or organizational aspects. And as researchers, we will be more interested in the transactional fabric (among all participating agents), the emergent-collaboration patterns and their evolution in time, and self-organization mechanisms.

In the project reported in this paper, we adopted the emergent-collaboration approach. Within this approach, we refer to the whole range of interactions taking place among students in terms of *educational transactions*. These transactions, which are the building blocks of emergent-collaboration, comprise the many-to-many teaching and learning interactions by which partners (students, teachers), holding defined goals, both contribute-to and are benefited-from the course's course of events. In this paper we depict, both in quantitative and qualitative terms, different instructional models involving educational transactions and emergent-collaboration processes as they evolved with the integration of Virtual-TAU (a Web-shell for supporting online learning) in the teaching of graduate courses in the Tel-Aviv University School of Education. Two main principles guided the implementation of the Web-shell into the academic teaching: (a) Virtual-TAU is not intended to replace the "real" courses by complete virtual courses. It is rather conceived as powerful tool

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complementing existent face-to-face teaching; and (b) The participating teachers adopted the goal to develop different models of integration of Virtual-TAU in their courses, rather than adopting one common model

Our study focused on the following questions:

1. What didactic modes have been devised for supporting emergent-collaboration learning processes?
2. What is the extent of participation of students and teachers in Virtual-TAU based emergent-collaboration learning processes?

Method

The study was conducted during the 1998/1999 and 1999/2000 academic years, focusing on six classes participating in four one-semester (12-14 weeks) courses. All courses dealt with theoretical and research aspects of using ICT in education: Cognitive technologies for learning (two classes: 'a' and 'b'); ICT- Based learning environments (two classes: 'c' and 'd'); Web-Based learning (class 'e'); and Virtual environments in education (class 'f'). The research population included 3 lecturers, 3 teaching assistants and 115 graduate students. Data were collected by means of: (a) log files of students' hits and page views within Virtual-TAU; (b) transcriptions of forums' and collaborative activities with the shell. Virtual-TAU, the Web-shell used in this project, is similar to commonly used shells (e.g, WebCT, Learning Space, see Collis, 1999).

Results

Web-supported emergent-collaboration modes

Our first research question relates to the variety of collaboration modes that emerged through the development of the Web-supported courses. The analysis and classification of the Web-supported educational transactions resulted in the following six functional categories:

1. Web-supported social interaction

This category refers to activities related to the consolidation and maintenance of the courses' social fabric. As an example of emerging social transactions, teachers reported all along the semester on the "Who's Tamy" effect: there was always a student, at the beginning of a class, asking to know who was her partner (i.e. Tamy) in the last night's forum discussion or chat exchange. In regular lecture-based courses it is a commonplace that participants get acquainted mainly with their limited group of friends or close classmates. There is little opportunity (and need) to interact, and therefore to want to know, "who's that Tamy". In contrast, within Web-based activities students meet each other (virtually) around different topics and discussion themes, prompting the motivation to meet each other (really) in the class. This emerging ingathering at the social level sets the ground for emergent-collaboration at the learning level.

2. Web-supported critical group-reading

In traditional academic courses reading is mostly an individual activity. Only part of the students participate in class discussions following reading assignments. In addition, the types of reading assignments are usually limited in format. Two outcomes could be clearly observed from the very early stages of this study. The first was the rich repertoire of reading-support tasks evolving as the courses proceeded, e.g., directed-reading discussion forums, e-papers contest, bibliographical-sources group synthesis and integration, or "apply-the-paper's-model" for group analysis of computer-based learning materials. The second was the dramatic increase in the students' reading performance, both in terms of scope and personal involvement. The requirement to participate in the group-reading tasks and to make concrete (written) contributions affected the students' disposition towards the bibliographical materials.

3. Synchronic and asynchronic issue-discussion

Exchange of ideas, opinions and beliefs about key issues can be considered at the core of group-based knowledge-building processes. The Web-environment offered the opportunity to expand (in frequency) and enrich (in quality) issue-discussion activities. For one aspect, these activities took place also in asynchronous

mode (in addition to only-synchronic class discussions), increasing considerably the number of group-discussion events. In another level, a variety of discussion configurations emerged (e.g., student-moderated, teacher-moderated, or non-moderated events at which the leading role in the debate passed among participants).

4. Peer evaluation and review

A key characteristic of knowledge generating communities, (e.g., scientific or professional communities) is the dissemination and mutual review of ideas and intellectual produce. In regular courses based on traditional teaching/learning means, there is little opportunity to exercise these types of transactions. In the courses included in this study, several forms of Web-based peer evaluation and review activities were developed, e.g., response to peers' contributions, formative evaluation of peers' work-in-progress, or judgment of peers' contributions in selection or contest tasks.

5. Collaborative construction of knowledge bases

The idea of the cooperative accumulation and preservation of knowledge generated by the group members stood behind the creation of activities at which the students were asked to contribute to a common knowledge base (e.g., the joint creation of an annotated database of educational Websites). The resulting knowledge bases not only served the learning of the original contributors, but also are now offered to new groups of students which in turn continue to enrich them.

6. Group-projects online presentation

A well-known phenomenon regarding courses' final assignments or projects is that these become mainly a teacher-student event. The student (or small group) hand out the work to the teacher (possibly after a couple of iterations), which is evaluated then stored with little chance that other students will read or use it as reference for further work. Within Virtual-TAU a project-presentation mode was developed, offering the students a platform for developing their work and making it public at any desired stage.

The above presented six modes of Web-based transactions developed by the courses' teachers, are but a sample of the promising ways the communication tools may contribute to both expand our repertoire of didactic solutions, and trigger more meaningful emerging-collaboration processes.

Students' Participation in Virtual-TAU Activities

Students' involvement and participation in Web-supported transactions was of no precedent compared to the situation in traditional courses. As students stated it: "I never worked so hard and so comprehensively in an academic course; I felt that the course is running after me; If two days pass without going into virtual TAU, I felt that I miss something important happening right now". Table 1 presents the extent of the students' participation in Virtual-TAU forums within the six courses participating in this study.

Course	No. of students	No. of forums	No. of entries to forums	No. of messages	Ave. messages per student	Entries Per student	Entries Per messages
a	20	4	400	90	4.5	20	4.4
b	22	6	431	196	8.9	20	2.2
c	18	8	815	231	12.8	45	3.5
d	15	5	745	346	23	50	2.2
e	30	7	1560	442	14.7	52	3.5
f	10	4	250	114	11.4	25	2.2
Total	115	34	4201	1419			
Course average	*19.2*	*5.7*	*700.1*	*236.5*	*12.3*	*36.5*	*3.0*

Table 1: extent of participation in the courses' forums

The overall figures reinforce in quantitative terms the students' subjective assertions. An average of 700 entries (site visits) per course (37 entries per student), and 237 messages per course's forums (12.3 messages per student), are indicators of intense Web-based activity. The individual student visited the courses' sites about 3-

4 times a week in average, out of which once a week in average contributed to a forum's discussion. These figures can be read also as indicator of two modes of engagement in the forums' activities, namely operational versus observational modes. About 3/4 of the times students entered a forum not to contribute a new message, but to observe what is currently going on in it (e.g., to trace the discussion, to check reactions to her messages). This is a clear evidence of the creation of a virtual-transactional-milieu within which the students' felt involvement and commitment to the course's concerns.

Table 2 summarizes data on students' participation in 25 forums, for different modes of emergent-collaboration. The two most intensive modes of emergent-collaboration in terms of students participation were the student-moderated issue discussion, and the collaborative construction of databases. The most frequently used mode by instructors was the Web-supported academic reading. Above half of students' contributions to the forum were responses to messages posted by others, implying an intense flow of transactions during the discussions.

Activities	No. of courses	No. of forums	average duration (weeks)	moderation	ave. No. messgs. per forum	% of responses	ave. No. messgs. per student
Social Interaction	3	3	5	none	49.3	50.7%	2.3
Web-Supported Reading	4	12	3.25	lecturer	33.3	41.1%	1.7
Issue Discussion	3	9	1.6	students	65.1	68.8%	3.9
Knowledge Base Construction	1	1	5	none	146	49.3%	4.9

Table 2: Students participation in selected activities

The following are examples of emergent-collaboration processes in two different instructional modes: student-moderated discussion and critical group reading.

Students-Moderated discussion groups

In course 'd' three issues were assigned for students-moderated discussion. For each forum, 3-4 students were appointed as discussion-moderation group. Their responsibilities were to work collaboratively aiming to (a) prepare the background for the discussion; (b) present it to all students participating in the forum (about 15); (c) open the discussion, and moderate it during two weeks; (d) summarize it with the class; and (e) post a report on it to the course's Website.

Two parallel processes took place during the moderation-group's work. The first was the collaboration process within the moderation group (e.g. meeting for planning, assigning rolls, writing up the report) following structured collaborative learning schemes. The second process comprised the emergent-collaboration transactions between the moderators and the rest of the students in the course.

Table 3 presents the extent of participation of the students in the three discussion groups of the course. In all these discussions, the enrolment was very high. An average of 19 messages were contributed to the discussion by each participant, more than three messages a week. Moderators involvement was also very high, although varied among groups. The use of additional communication tools (e.g. polls, chat, e-mails) was also an initiative of the student-moderators.

	Forums (no. of messgs.)		Poll	Chat	e-mail (to whole group)
	Total	moderators			
Issue 1	87	27	√	√	1
Issue 2	108	50	-	-	4
Issue 3	90	14	√	-	2
Average	**19.1**	**30.3**			

Table 3: Usage of communication tools as facilitator of emergent-collaboration during three two-week student-moderated discussion groups (n=15).

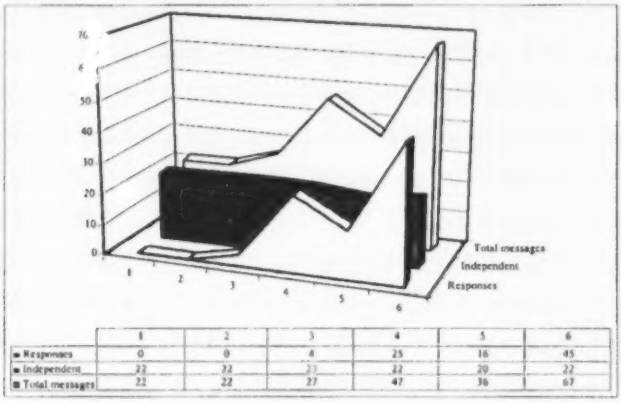
According to the self-report of all the students that served as moderators, their role was extremely effortful, and meaningful. As one of the students stated it, "This activity was extremely demanding both because of the intensity of our moderation group interaction and the responsibility we shared in keeping the

discussion alive and on high level. However, I learned a lot from the processes, and enjoyed it very much. I think this kind of activity should be integrated in many more courses". One of the concerns of the moderators was how to engage the entire class in the discussion. Therefore, they invested a lot of time and creativity to create a contextual-framework to the discussion, and used e-mail to encourage their classmates to participate.

Web-supported Critical Group-Reading

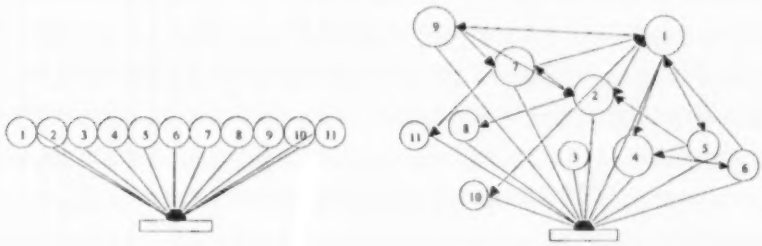
Bibliographical resources are essential components of any academic course, serving as raw materials for the implementation of diverse learning formats (e.g., class debates, public trials, topical surveys). In most courses the students do critical reading at a limited extent due to diverse reasons, e.g., the size of the class, students' degree of motivation and perception of the readings' learning value, or even language barriers.

Figure 1 shows the evolvement of the transactional volume in quantitative terms. The course (22 students) included six forums focusing on critical-reading tasks. For the first two forums, each student entered one message, according with the minimal requirements. By the fourth task the participation increased notably, up to a triplication of the initial values in the last task. The interesting aspect of these figures are that the number of independent contributions remained the same for all tasks, while the amount of responses to each other messages increased - none at the beginning up to 45 in the last task.



	1	2	3	4	5	6
Responses	0	0	4	25	16	45
Independent	22	22	23	22	20	22
Total messages	22	22	27	47	36	67

Figure 1: Number of transactions in six forums of a course



Forum task 1 Forum task 6

Figure 2: transactional patterns for two task forums

However, a clearer evidence of the emerging collaboration patterns can be appreciated if the transactional map is depicted as in Figure 2. For clarity reasons, only half of the students are represented. In task forum 1 at the beginning of the course, all contributions were made independently (only one per student). This

configuration gradually changed, becoming in task 6 an intricate web-like pattern. Active subgroups emerged (e.g., students 1-2-4, and 7-9). And analysis of the content of the messages showed that this subgroups, besides participating in the debate, assumed a variety of functions (e.g., moderation, information supply).

Discussion and Conclusions

The first question addressed in the study focused on the different modes of Web-based transactions that emerged during the planning and implementation of the experimental courses. At the level of this particular study, the reported results show that even within its limited setting (e.g., six courses, three teachers, and a Web shell in prototypical stage) a fairly interesting set of learning assignments and collaborative tasks emerged. The learning events ranged from transactions aimed at supporting group reading and bibliographical work, up to the development and (digital) presentation of collaborative projects. At a more general level, the results represent a valuable (if modest) contribution to the endeavor shared by many educators and researchers aiming to define new pedagogical schemas (a Webagogy?) fitting the features and qualities of the Web technology (e.g., see Mioduser et al., 1999).

The second research question aimed to examine the extent and quality of participation of the students in the different activity modes, with the support of the Web tools. The results unveiled an intense involvement of students and teachers in the courses' activities. The distinction between two modes for visiting the courses' sites, namely operational and observational modes, was also a revealing indicator of the students' continuous concern with the courses' affairs. The students' perceptions of their experience can be summarized by one participant's claim that the course, instead of a "14-meetings-course", became a "14-weeks-course". The sense behind this claim is that while the traditional course was perceived as a series of discrete events (namely class meetings, and limited time spent in out-of-class assignments), it is now perceived as continuous intellectual engagement comprising face-to-face as well as virtual meetings, and anytime/anywhere transactions among all partners. However, it should be noted that the complementary aspect of taking part in continuous learning transactions and being mindfully attentive to the others' (students, teachers) requirements -is an increase in time and effort devoted to a course's affairs

The experience reported in this paper also represents an alternative view about the role of advanced learning technology in distance learning processes. By the traditional view the main focus is on individualization of the instruction, allowing each student to engage in learning activities at her own pace and demand. In contrast, this study focused on harnessing Web-based tools in support of collaborative processes that are of great contribution to the individuals' learning. From this perspective, we expect a major role of the Internet in education to be to support and enhance collaboration and socialization processes among students. In addition to the traditional model based on one-individual access to distant knowledge resources, we expect the multiple-participants transactional model to be come a central component in the development and implementation of novel distance learning systems.

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